Integrated Academics

In

CTE

University of Arizona Team
ADE/CTE

Judy Balogh, Deborah Helms, Steve Mulhearn, & Lynne Storms

Rotational Basis

Standards Validation –

- Determines which current standards are included, discarded, or amended
- It is the **WHAT** is taught in our programs
- Comprised of mostly INDUSTRY EXPERTS, as they are most in-touch with the industry, trends and skills needed to succeed

Assessment Workshops –

- Aligns assessment items with the newly validated standards
- Using data from previous assessments, items are included, discarded, or amended
- New assessment items are created for the new standards, as well as the retained or amended standards

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Crosswalk Workshops

- Determine where the Academic concepts (Math, Economics, & Science) are embedded in the CTE curriculum **and/or**
- Realign items as program standards are updated and add more
- Extract & perfect the academic concepts, and align the Econ Standards within the Program Technical Standards
- Decide the **HOW & WHEN** the Academic standards should be taught within the curriculum.
- Utilize CTE Teachers & Academic Teachers

Professional Development Workshops

- Work with Program Specialists to offer special PD opportunities for CTE teachers
- Coordinate both industry driven and academics driven PD (ex. Ford)
- Process registrations, invoices, and related paperwork
- Examples: Math in CTE Cohort, Economics Boot Camp, Mathematics Boot Camp

Steve Mulhearn – Integrated Academics Specialist, U of A/ADE/CTE

- Math, Economics, Science
- CTE/Academic Crosswalks
- Integrated Academics Website (azed.gov – CTE)
- Quality resources for integrated (EMBEDDED) academics, credit & non-credit
- Professional Development – 2015-16
  Math in CTE Cohorts, Economics & Math Boot Camps
- Focus on QUALITY & INTEGRITY

CTE Programs ELIGIBLE for Academic Credit

(Pending local governing board approval)

Approved as eligible for a 4th credit in mathematics

- Accounting and Related Services
- Architectural Drafting
- Automotive Technologies
- Business Management and Administrative Services
- Construction Technologies
- Engineering Sciences
- Mechanical Drafting
- Software Development
- Welding Technologies

CTE Programs ELIGIBLE for Academic Credit

Approved as eligible for .5 credits in economics:

- Agribusiness Systems
- Entertainment Marketing
- Entrepreneurship
- Professional Sales and Marketing

Approved for 1 credit in science if the programs offers a 3 Carnegie Unit course sequence and 2 credits in science if programs offers a 4 Carnegie Unit course sequence:

- Agribusiness Systems
- Animal Systems
- Environmental Service Systems
- Food Products and Processing Systems
- Natural Renewable Resources Systems
- Plant Systems
- Power, Structural and Technical Systems

Math In CTE Cohort

- 1 Team (CTE & Math Teacher)
- 5 Meetings/3 Different Locations - Phoenix, Tucson & Remote in 2015-16
- September – April vs. August – June
- Utilize a Nationally researched model for “Maximizing the Math” in lesson planning.
- EMBEDDED Math is EXTRACTED from the CTE standards with the Math teacher formalizing the Math instruction (vs. Integration)
- Gives the CTE teacher the confidence & knowledge necessary to deliver the CTE lesson and necessary Math concepts embedded within
- 7-step, thorough model makes it simple for other teachers to follow the steps and successfully deliver the lessons

Mathematics Experts

Lee Jessen – Academic Integration Specialist, Pima JTED

Jerrad McMurrich – Flowing Wells HS, Automotive Technologies

Trained by NRC CTE – National Research Center for Career & Technical Education

Are You Smarter Than A 12th Grader?

Time to put yourself in a student's shoes!

Cooling Systems

Calculate Adjusted Boiling Temperature

Jump Start

- Think back to a time when you were in a car that overheated.
- Share your experiences with a partner and be ready to share with the class.

www.dreamstime.com

Math Check

1. Find the slope of the line that passes through the points (2, 6) and (-1, 3).

2. Convert 3 days to minutes using dimensional analysis.

3. Evaluate $4a-3b \; if \; a=-2 \; and \; b=-1.$

Math Check Answers

1. Find the slope of the line that passes through the points (2, 6) and (-1, 3).

$$m=\frac{y_2-y_1}{x_2-x_1}=\frac{(3)-(6)}{(-1)-(2)}=\frac{-3}{-3}=1$$

1. Convert 3 days to minutes using dimensional analysis.

$$\frac{3\,\text{days}}{1}\bullet\frac{24\,\text{hours}}{1\,\text{day}}\bullet\frac{60\,\text{minutes}}{1\,\text{hour}}=4320\,\text{minutes}$$

2. Evaluate $4a-3b \; if \; a=-2 \; and \; b=-1.$

$$4(-2)-3(-1)=-8+3=-5$$

Importance of the Cooling System

- With your partner, brainstorm and list 2 reasons a cooling systems fails.

- As non-volunteers are called upon add to your list.

Objectives:

You will be able to:

1. Identify the radiator cap
2. Explain the radiator cap's function and the information that can be obtained.
3. Calculate the adjusted boiling temperature
4. Convert kilopascals to PSI
5. Convert bars to PSI
6. Apply learning to live vehicles.
7. Graph pressure and temperature

Physical Characteristic

- Three states of water:

1. Gas
2. Liquid
3. Solid

List an example of each

State of Water Example

1. Add water to the pot (name state of the water)
2. The water will boil at (state temperature)°
   (name state of water)
3. Adding the lid creates a
   (open or closed) system.

http://www.bcscience.com/bc10/images/0_quiz-10.1-05.jpg

Radiator Caps and Cooling System

1. Cooling system is a closed system.
2. The spring is the relief valve for the system.
3. The cap is serving the same function as the lid on the pot.
4. Locate the spring in the cap. They are rated in PSI. Find where the rating is located on the cap when the cap comes to you.

Thumbs up / Thumbs down

Did you already know this information?

Automotive Cooling System

- Automotive cooling system, as a boiling pot of water with a lid is a closed system.
- Pressure in the pot or cooling system will increase due to the expansion of the water or vaporization.
- As pressure rises the boiling point rises.
- Summarize in one sentence.

Adjusted Boiling Temperatures

- To compute the adjusted boiling temperature:
- 1. Multiply the radiator cap by 3° .
- 2. Add the boiling point of water + 212°
- 3. Add the answers to #1 and #2
- Formula: ABT=(3°)lbs+212°

- Example: A 13 pound radiator cap
- 1. (3°)13 = 39°
- 2. 39° + 212° = 251° ABT = 251°

U-try ABT

1. 16 pound radiator cap

2. 10 pound radiator cap

3. 3 pound radiator cap

4. Explain the steps to your partner. Switch.

Be ready to share when called upon.

Check your answers

1. 16 pound radiator cap 260°

   3° (16) + 212° = 260°

2. 10 pound radiator cap 242°

   3° (10) + 212° = 242°

3. 3 pound radiator cap 221°

   3° (3) + 212° = 221°

Converting Kilopascals(kPa) to PSI

- Some radiator caps are not measured in PSI but in **kilopascals** (kPa)

www.cdxtextbook.com

- Conversion factor: 1psi=6.894 kPa

Remember that your answer must be a **whole** number to match the labeling on radiator caps.

Example: Converting kPa to PSI

Example:

Convert 110 kPa to PSI

Cancel units to achieve desired unit

$$\frac{110\,\cancel{\text{kPa}}}{1} \bullet \frac{1\,\text{PSI}}{6.894\,\cancel{\text{kPa}}} = 15.956 \approx 16\,\text{PSI}$$

U-try converting kPa to PSI

1. 103 kPa

2. 90 kPa

3. 20 kPa

- Compare with your partner

Check your answers

1. 103KPA $\frac{103\,\text{kPa}}{1} \cdot \frac{1\,\text{PSI}}{6.894\,\text{kPa}} = 14.941 \approx 15\,\text{PSI}$

2. 90KPA $\frac{90\,\text{kPa}}{1} \cdot \frac{1\,\text{PSI}}{6.894\,\text{kPa}} = 13.055 \approx 13\,\text{PSI}$

3. 20KPA $\frac{20\,\text{kPa}}{1} \cdot \frac{1\,\text{PSI}}{6.894\,\text{kPa}} = 2.901 \approx 3\,\text{PSI}$

Example: Converting BARS to PSI

- 1 bar = 1 atmosphere = 14.5 PSI
- Example: Convert 0.9 (bar) to PSI

$$\frac{0.9\,bar}{1} \bullet \frac{14.5\,PSI}{1\,bar} = 13.05 \approx 13\,PSI$$

Remember that your answer must be a **whole** number to match the labeling on radiator caps.

U-try!

- Convert 1.1 (bar) to PSI

U-try! Answer

- Convert 1.1 (bar) to PSI

$$\frac{1.1\,bar}{1} \bullet \frac{14.5\,PSI}{1\,bar} = 15.95 \approx 16\,PSI$$

A


DANGER
WARNING
危 険
1.1

B


FOR COMPETITION USE
1.3
SKUNK2
RACING
DANGER HIGH PRESSURE

C


ENGINE COOLANT
CHECK LEVEL IN BOTTLE
ALIGN VENT
WITH TUBE
CAUTION
NEVER OPEN HOT

D


NEVER OPEN HOT!
SURGE TANK
RUIAN XINYUAN AUTO
120 kPa
RESERVIOR D'EXPANSION
NE JAMAIS OUVRIR A CHAUD

E


熱いと危険
NO ABRE CUANDO CALIENTE
R125
88kPa
NEVER OPEN
WHEN HOT
MADE IN
0.9
JAPAN

F


TURN TIGHT
AC
15#
REMOVE SLOWLY

G


CAUTION
YOU CAN BE BURN
NEVER OPEN HOT.
ALWAYS OPEN SLOWLY
15 PSI
ENGINE COOLANT

H


NEVER OPEN WHEN HOT
HKS
127kPa
(1.3kg/cm²)
HKS Company Limited. Pursuing the Ultimate in Engine performance and Efficiency

A

bars

B

bars

C

PSI

D

kPa

E

bars & kPa

F

PSI

G

H

kPa

Answers

Practical Application

- Students will be assigned to vehicles in the shop.
- Utilizing a repair order locate the radiator cap and calculate the adjusted boiling temperatures of the vehicles cooling system.

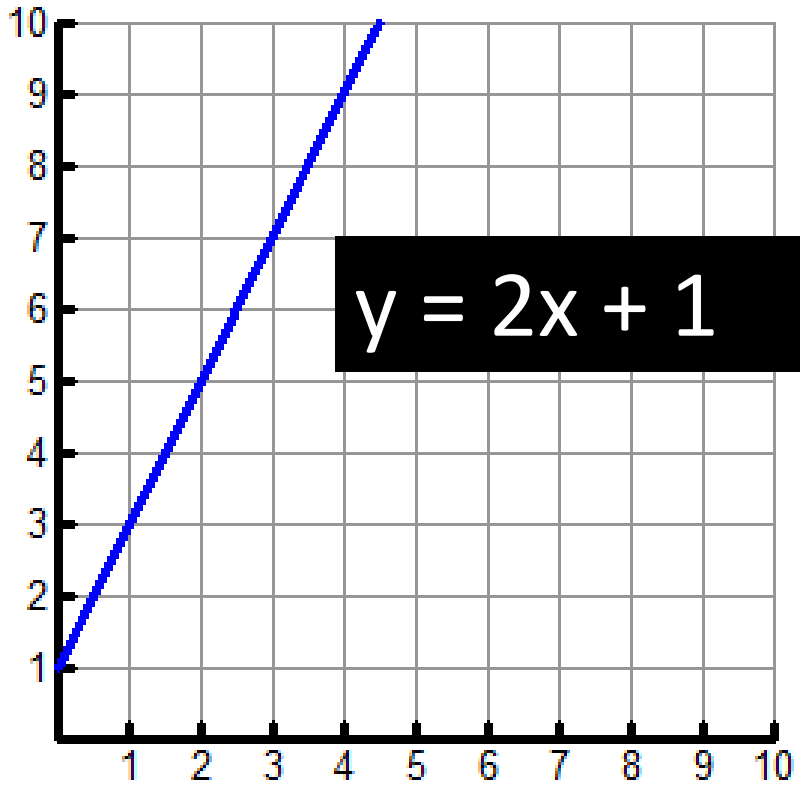
Check your Math Knowledge

- Think back to algebra class and write down the formula of a line.

- Check with your partner.

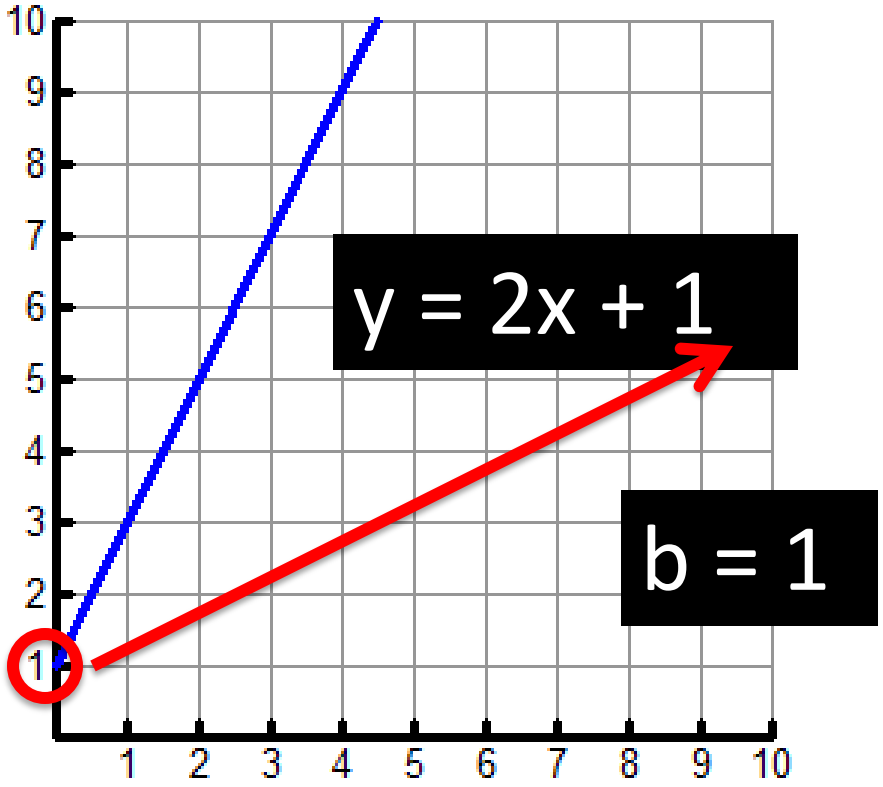
Equation of a line.

- y = mx + b Find m and b



Equation of a line.

- y = mx + b



Equation of a line.

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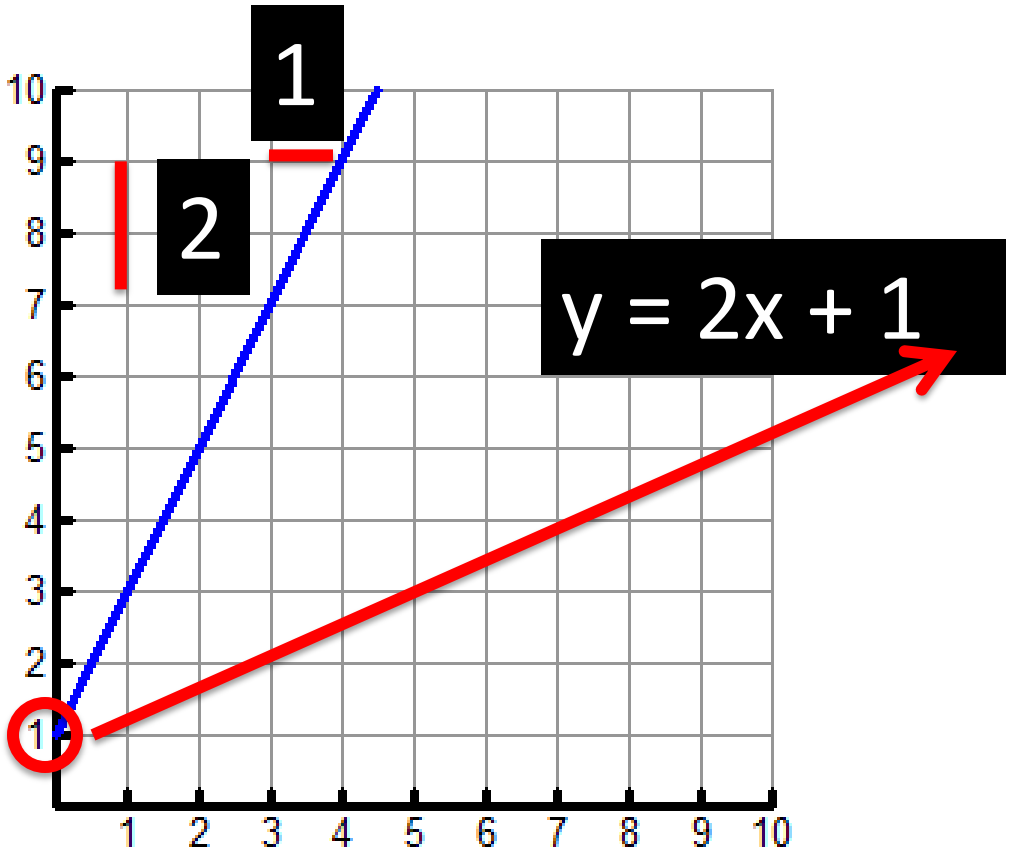
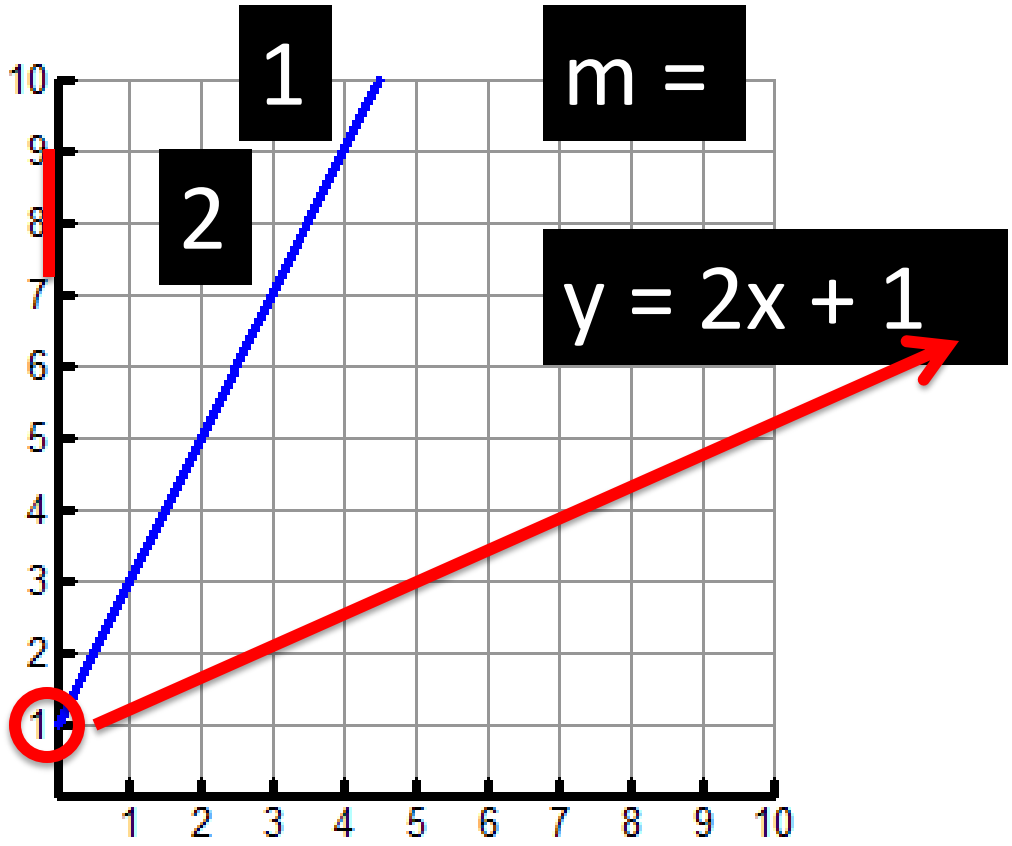


Equation of a line.

- $y = mx + b$



Equation of a line.

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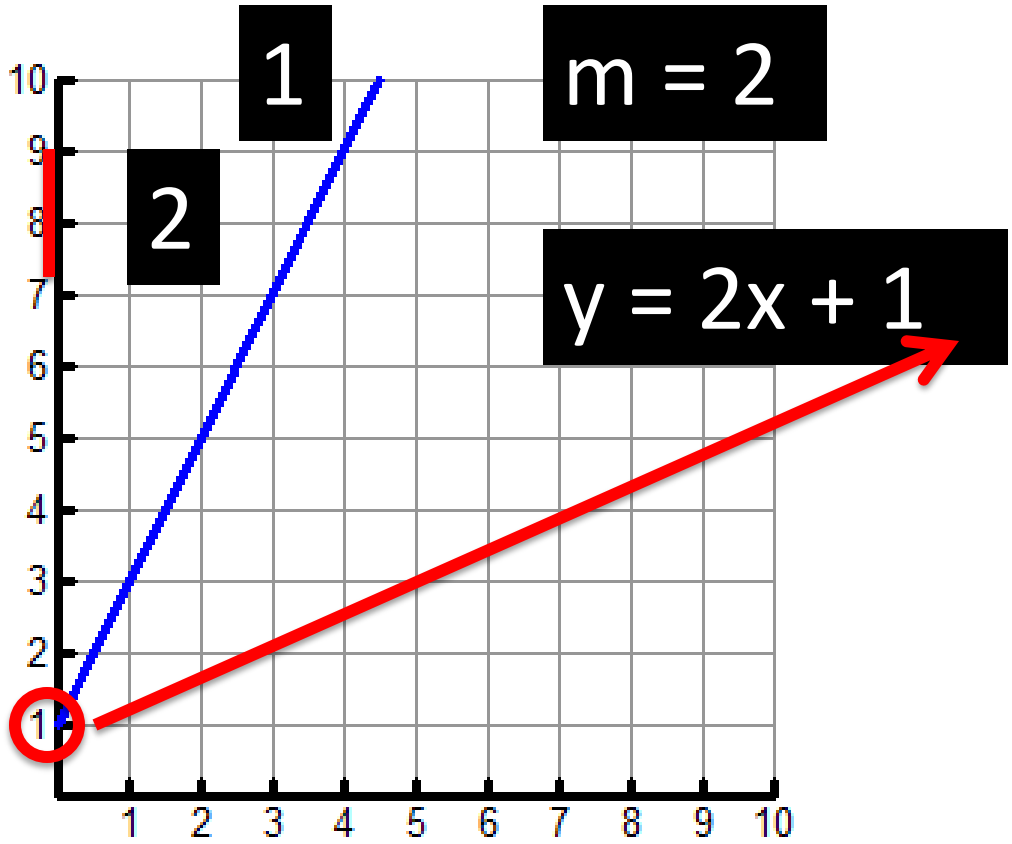
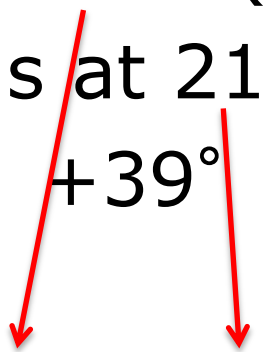


Thumbs up / Thumbs down

Did you identify the slope (m) and the y-intercept (b) correctly?

Using the information to create an equation:

- 13 pound radiator cap
- Math Sample 13˚ (3)=39˚
- Water boils at 212˚
- Add 212˚ +39˚ = 251˚



- y = mx + b
- Our equation becomes:
- y = 3x + 212˚

Using the Information

- Let's use two radiator caps and find the if the ordered pair lie on the line.
- On your notes calculate the ABT of the below radiator caps.
  - 6 PSI
  - 10 PSI

Using the information Answers

Ordered pair (psi, ABT)

$$y = 3x + 212^{o}$$
$$y = 3(6^{o}) + 212^{o}$$
$$y = 18^{o} + 212^{o}$$
$$y = 230^{o}$$

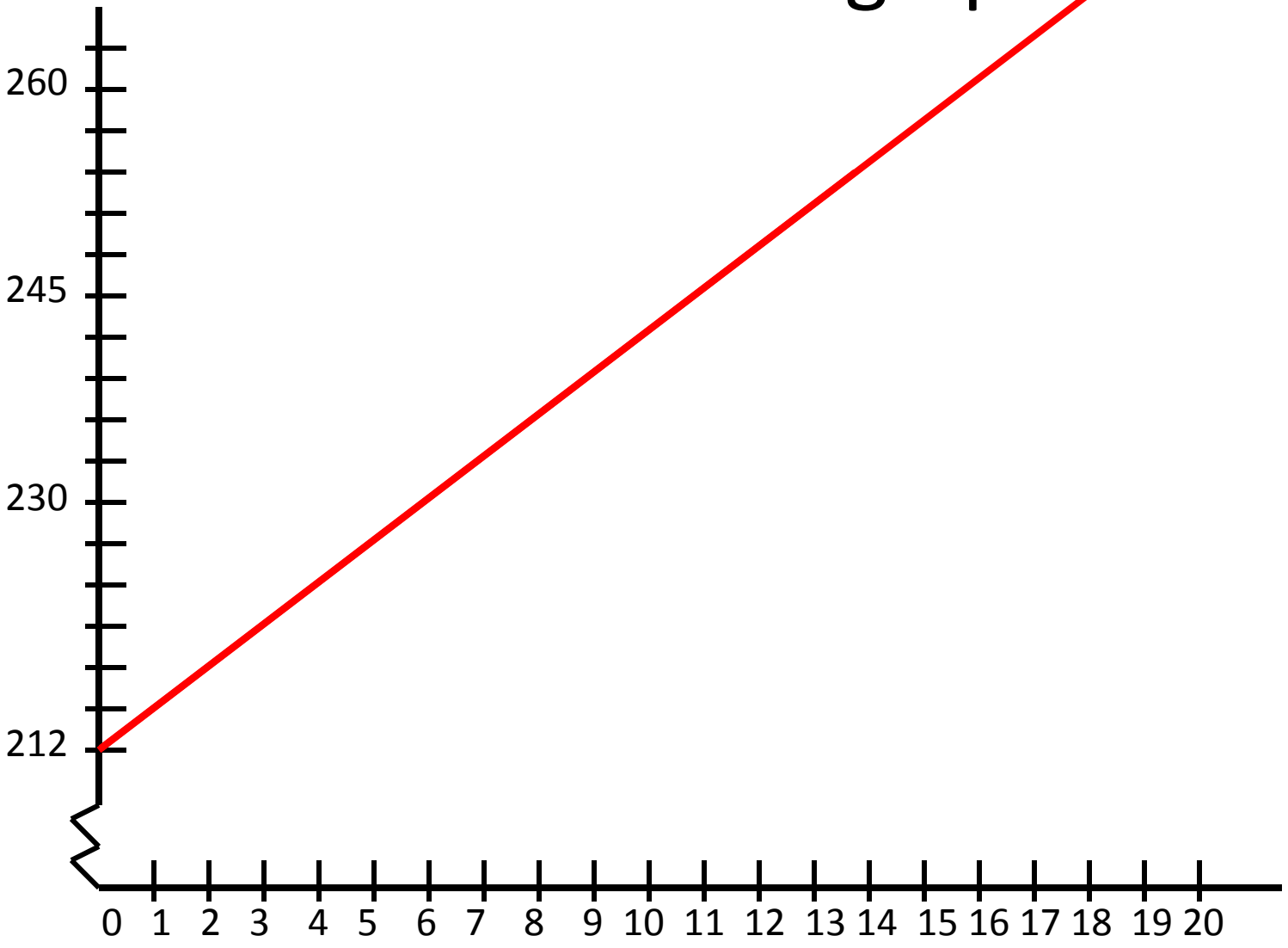
(6, 230)

$$y = 3x + 212^{o}$$
$$y = 3(10^{o}) + 212^{o}$$
$$y = 30^{o} + 212^{o}$$
$$y = 242^{o}$$

(10, 242)

Equation: y = 3x + 212

Let's take a look at the graph.



Equation: y = 3x + 212

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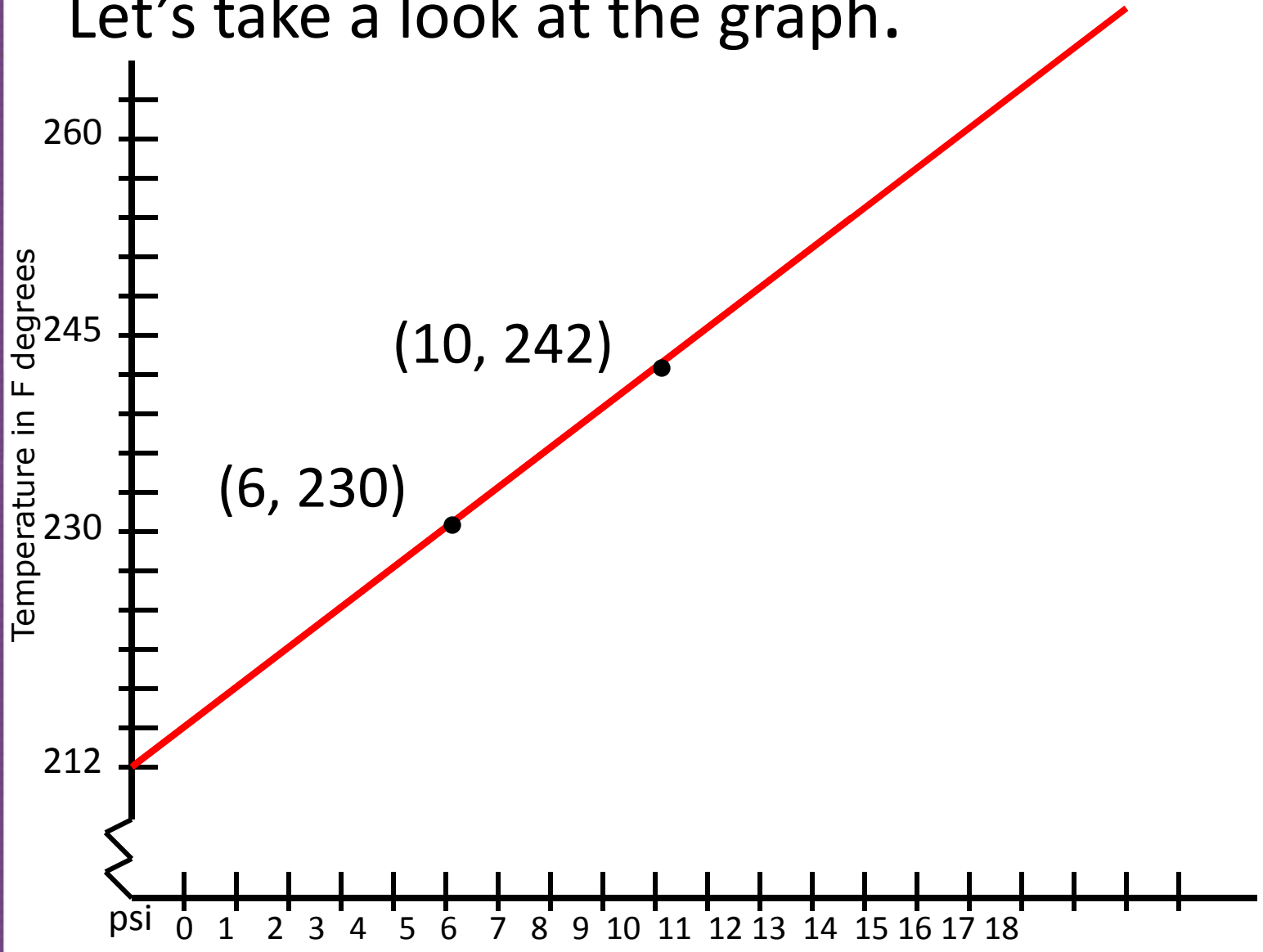

Equation: y = 3x + 212

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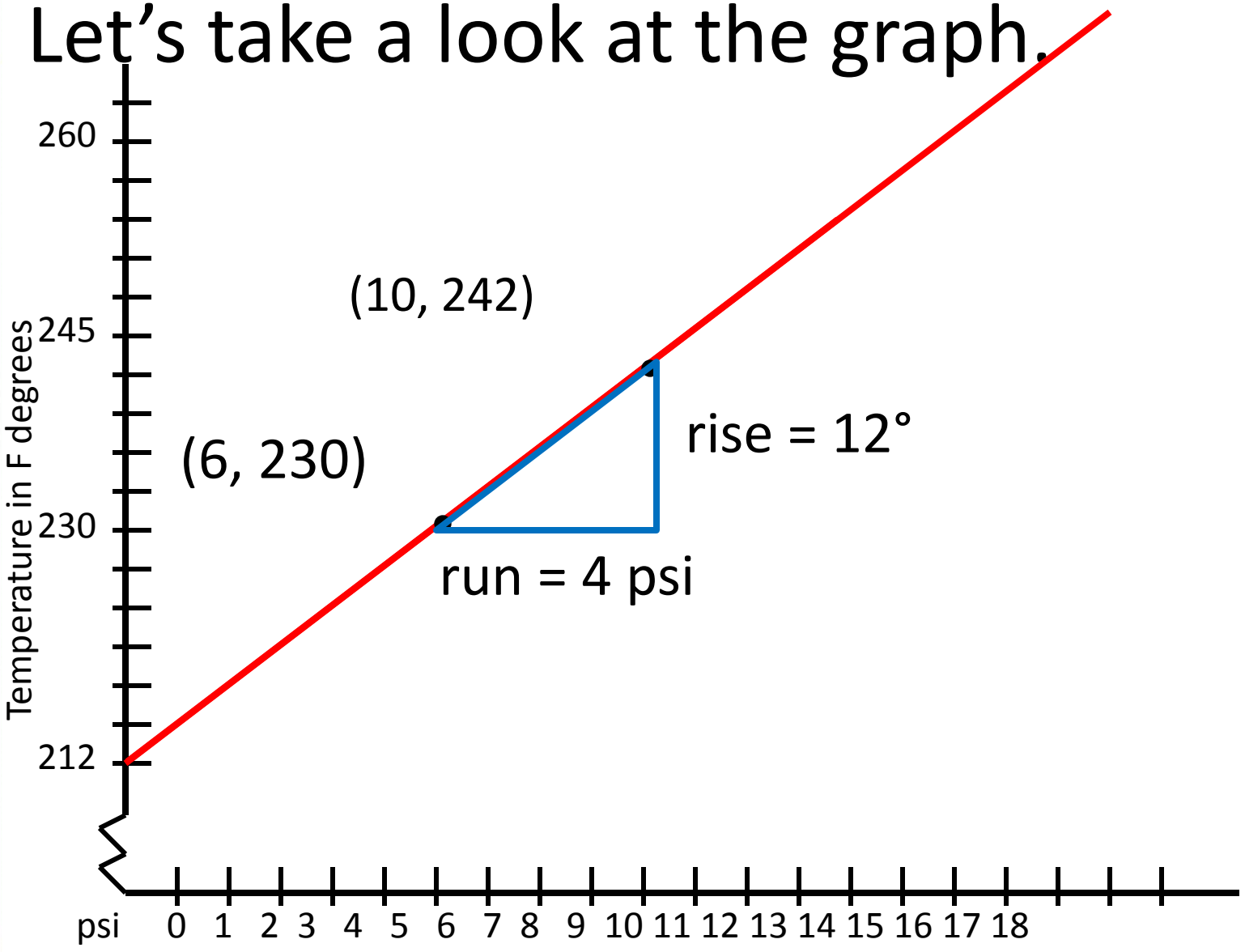


Slope (m)

$$\frac{rise}{run}$$

$$\frac{12^{o}}{4\ psi} = \frac{3^{o}}{1\ psi}$$

$$m = \frac{3^{o}F}{1\ psi}$$

y-intercept (b)

- 212°
- b=212°

- This means without a radiator cap water boils at 212°

Activity:

Choose two radiator caps between 1 and 16psi and calculate the adjusted boiling temperature for each or use the ones from your time in the shop.

Activity:

Choose two radiator caps between 1 and 16psi and calculate the adjusted boiling temperature for each.

Plot these two points on the graph provided.

Activity:

Plot these two points on the graph provided.

Draw the line connecting your points.

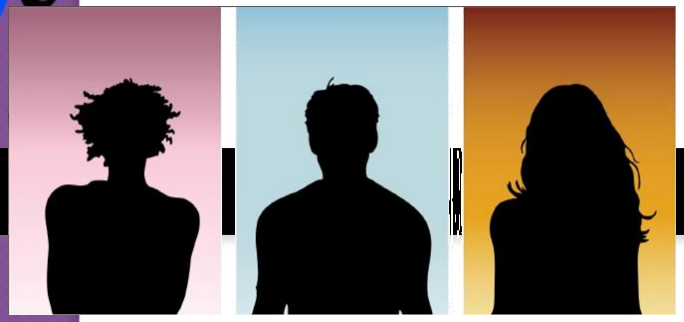
Activity:

Plot these two points on the graph provided.

Draw the line connecting your points.

Verify the equation of your line by finding the slope m, and the y-intercept, b.

3-2-1 Test Drive



3 ideas you learned today

2 mathematical ideas used in today's lesson

1 summary sentence about how pressure affects boiling temperature